

Atmospheric molecular hydrogen (H₂) at the WMO/GAW stations in China

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Atmospheric molecular hydrogen (H₂) mole fractions have been measured at the two WMO/GAW stations in China, which are Mt.Waliguan (WLG) global station and Shangdianzi (SDZ) regional station. The samples at WLG were collected and analysed at the Earth System Research Laboratory of National Oceanic and Atmospheric Administration (NOAA). The H₂ at SDZ were in-situ measured by a GC-HePDD system. In the study, we present the atmospheric H₂ time series from May 1991 to May 2014 at WLG and from 2015 to 2016 at SDZ, and investigate the seasonal and inter-annual variations.

The results at WLG indicate the influence of terrestrial ecosystem, corresponding to the midlatitude to high-latitude Northern Hemisphere. Annual mean background H₂ mole fractions at WLG vary from a minimum of 496±7 ppb (parts per billion, 10⁻⁹ dry air mole fraction) in 1997 and 2004 to a maximum of 515±3 ppb in 1998, with a mean (± standard deviation) of 503±2 ppb during the observation period. The atmospheric H₂ show decreasing trend with an average growth rate of -0.8±0.6 ppb y⁻¹. The highest background H₂ mole fraction is observed in March, while the lowest is observed in October. Peak-to-trough amplitude in the seasonal cycle is 23±7 ppb.

Atmospheric H₂ mole fractions at SDZ vary from a minimum of 381 ppb (parts per billion, 10⁻⁹ dry air mole fraction) to a maximum of 1535 ppb, with a median of 510 ppb and a mean (± standard deviation) of 555±113 ppb during the observation period. The highest regional representative H₂ mole fraction is observed in July, while the lowest is observed in October, which is different with the WLG. Peak-to-trough amplitude in the seasonal cycle is 63±3 ppb. H₂ mole fractions show night time depletion in all seasons, and the atmospheric H₂ mole fractions are also influenced by local surface wind direction at SDZ.